Biomimetic sol–gel synthesis using alkoxysilane derivatives (gel precursors) and natural polysaccharides (templates) is one of the current directions for obtaining hybrid hydrogel materials for medical purposes.

In this work, polymeric glycerohydrogels in the form of thin-film plates were obtained by biomimetic sol–gel synthesis using silicon tetraglycerolate, chitosan L-(D-)aspartate (CS·L-(D-)AspA), and glucomannan. The surface microrelief of the samples was examined by atomic force microscopy, and the level of supramolecular structuring of their polymer phase was assessed by X-ray diffractometry. A comparative analysis of the adhesion, spreading and proliferation rate *in vitro* of epithelial-like cells of the rhesus macaque embryonic kidney MA-104 and epithelial cells of human fibroblasts and keratinocytes in the presence of CS·L-(D-)AspA was carried out.

It has been established our glycerohydrogel plates based on CS·L-AspA and CS·D-AspA are represented by interpenetrating spatial networks of both organic and inorganic nature, filled with a water–glycerol medium. For the CS·L-AspA plates, a predominantly “needle-like” relief is visualized with a predominance of protrusions up to 4.2 μm high, while a “needle-grained” relief is characteristic for the CS·D-AspA ones with protrusions up to 2.8 μm high and pores with diameters of ~3–10 μm. The solid phase from the corresponding plates showed a dense amorphous–crystalline ordering of the polymeric substance compared to the solid phase isolated from CS·L-(D-)AspA in the absence of silicon polyolate networks and a bioinert template. The addition of CS·L-(D-)AspA to the nutrient medium to cultivate MA-104 epithelial cells, human fibroblasts and keratinocytes accelerates the adhesive and proliferative activity *in vitro* of the cell cultures tested.

These features allow us to consider our glycerohydrogel plates based on CS·L-(D-)AspA as promising biomimetic substrates to form tissue-engineered structures with a pregiven set of properties and accelerated growth of populations of epithelial and epitheliopod cell cultures.